

TFT LCD Preliminary Specification

MODEL NO.: N141X7 -L05

Customer : _____

Approved by : _____

Note :

Liquid Crystal Display Division		
QRA Dept.	TD Division.	PDD I Dept.
Approval	Approval	Approval
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**REVISION HISTORY**

Version	Date	Page (New)	Section	Description
Ver 1.0	Dec. 04. '02	All	All	Preliminary specification first issued.



1. GENERAL DESCRIPTION

1.1 OVERVIEW

N141X7 -L05 is a 14.1" TFT Liquid Crystal Display module with single CCFL Backlight unit and 30 pins LVDS interface. This module supports 1024 x 768 XGA mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The inverter module for Backlight is not built in.

1.2 FEATURES

- Thin and light weight
- XGA (1024 x 768 pixels) resolution
- DE (Data Enable) only mode
- 3.3V LVDS (Low Voltage Differential Signaling) interface with 1 pixel/clock
- SPWG (Standard Panel Working Group) Style B compatible

1.3 APPLICATION

- TFT LCD Notebook

1.4 GENERAL SPECIFICATIONS

Item	Specification	Unit	Note
Active Area	285.7 (H) x 214.3 (V) (14.1" diagonal)	mm	(1)
Bezel Opening Area	288.7 (H) x 217.55 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1024 x R.G.B. x 768	pixel	-
Pixel Pitch	0.279 (H) x 0.279 (V)	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hardness (3H), Anti-glare (Haze 40)	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal(H)	298.5	299.0	299.5	mm	(1)
	Vertical(V)	226	226.5	227	mm	
	Depth(D)	-	5.2	5.5	mm	
Weight		-	400	415	g	-
I/F connector mounting position		The mounting inclination of the connector makes the screen center within ±0.5mm as the horizontal.				(2)

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

(2) Connector mounting position



2. ABSOLUTE MAXIMUM RATINGS

2.1 ABSOLUTE RATINGS OF ENVIRONMENT

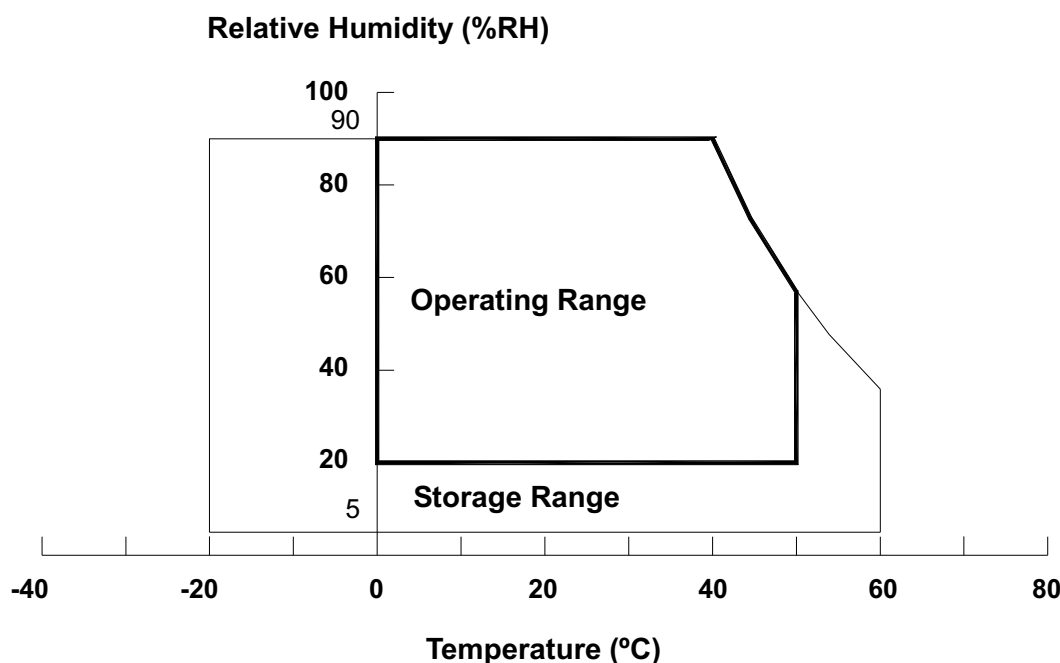
Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T _{ST}	-20	+60	°C	(1)
Operating Ambient Temperature	T _{OP}	0	+50	°C	(1), (2)
Shock (Non-Operating)	S _{NOP}	-	210	G	(3), (5)
Vibration (Non-Operating)	V _{NOP}	-	1.5	G	(4), (5)

Note (1) Temperature and relative humidity range is shown in the figure below.

(a) 90 %RH Max. (Ta ≤ 40 °C).

(b) Wet-bulb temperature should be 39 °C Max. (Ta > 40 °C).

(c) No condensation .

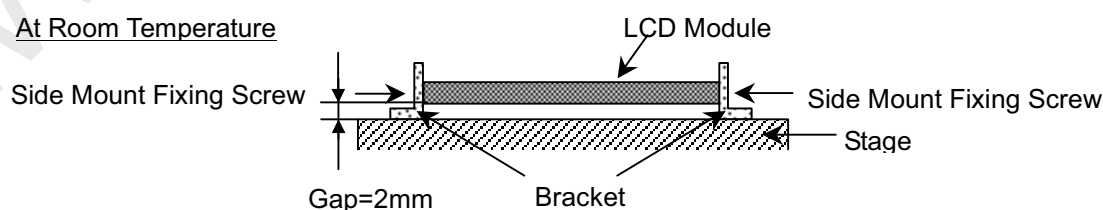


Note (2) The temperature of panel surface should be 0 °C Min. and 50 °C Max.

Note (3) 2.5ms, half sine wave, 1 time for ± X, ± Y, ± Z.

Note (4) 10 ~ 200 Hz, 0.5 Hr / Cycle, 1 cycles for each X, Y, Z. The fixing condition is shown as below:

At Room Temperature



Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid enough so that the module would not be twisted or bent by the fixture.

2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V _{CC}	-0.3	+4.0	V	(1)
Logic Input Voltage	V _{IN}	-0.3	V _{CC} +0.3	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Lamp Voltage	V _L	-	2.5K	V _{RMS}	(1), (2), I _L = (6.0) mA
Lamp Current	I _L	-	7.0	mA _{RMS}	
Lamp Frequency	F _L	-	85	KHz	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for lamp (Refer to Section 3.2 for further information).

3. ELECTRICAL CHARACTERISTICS

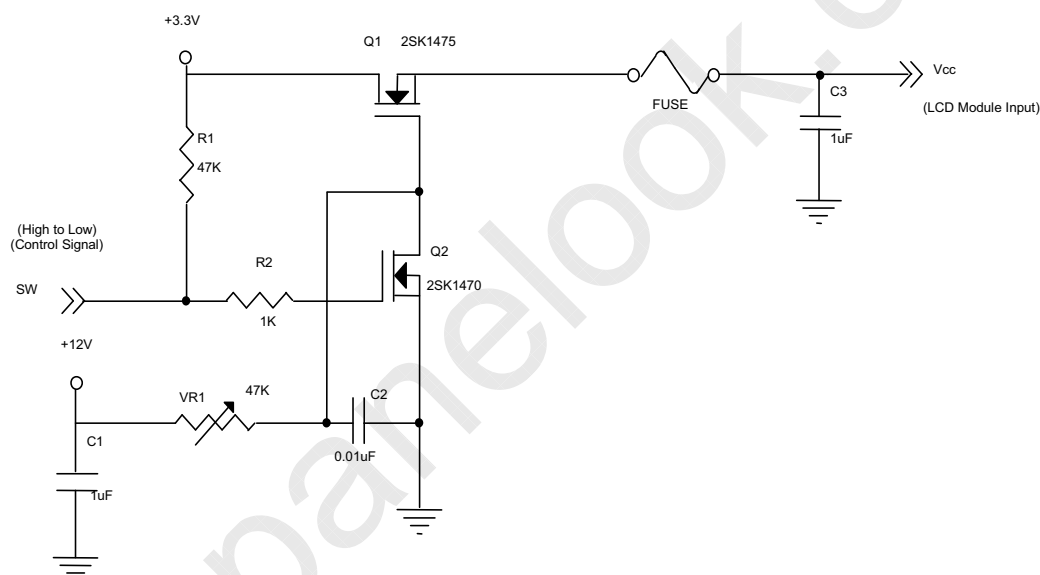
3.1 TFT LCD MODULE

Ta = 25 ± 2 °C

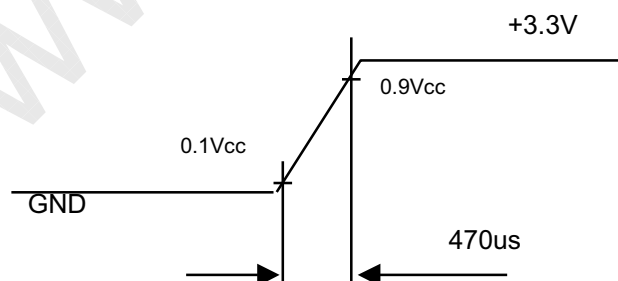
Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		V _{CC}	3.0	3.3	3.6	V	-
Ripple Voltage		V _{RP}	-	-	100	mV	-
Rush Current		I _{RUSH}	-	-	1.5	A	(2)
Power Supply Current	White	I _{CC}	-	300		mA	(3)a
	Black		-	350		mA	(3)b
	Vertical Stripe		-	350		mA	(3)c
Differential Input Voltage for LVDS Receiver Threshold	"H" Level	V _{IH}	-	-	+100	mV	-
	"L" Level	V _{IL}	-100	-	-	mV	-
Terminating Resistor		R _T	-	100	-	Ohm	-

Note (1) The module should be always operated within above ranges.

Note (2) Measurement Conditions:



Vcc rising time is 470us



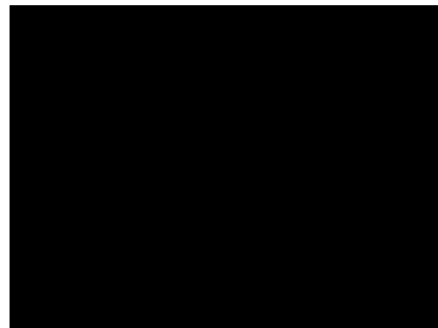
Note (3) The specified power supply current is under the conditions at $V_{CC} = 3.3\text{ V}$, $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$, DC Current and $f_v = 60\text{ Hz}$, whereas a power dissipation check pattern below is displayed.

a. White Pattern



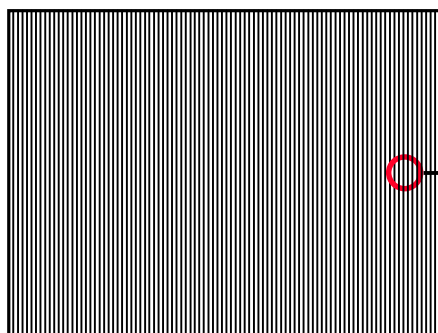
Active Area

b. Black Pattern

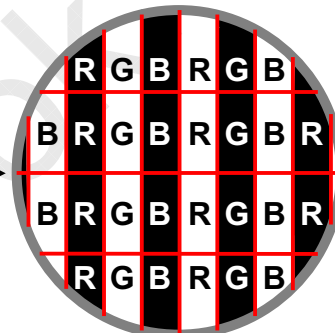


Active Area

c. Vertical Stripe Pattern



Active Area

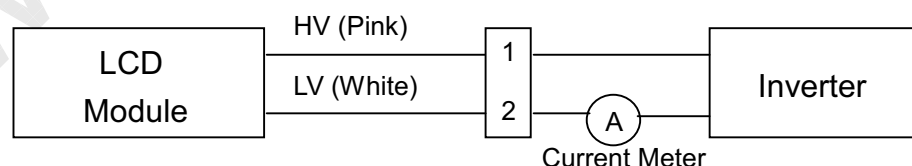


3.2 BACKLIGHT UNIT

 $T_a = 25 \pm 2\text{ }^{\circ}\text{C}$

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
Lamp Input Voltage	V_L	576	640	704	V_{RMS}	$I_L = 6.5\text{ mA}$
Lamp Current	I_L	2.0	6.5	7.0	mA_{RMS}	(1)
Lamp Turn On Voltage	V_S	-	-	1110 (25 $^{\circ}\text{C}$)	V_{RMS}	(2)
		-	-	1450 (0 $^{\circ}\text{C}$)	V_{RMS}	(2)
Operating Frequency	F_L	40	-	80	KHz	(3)
Lamp Life Time	L_{BL}	10,000	-	-	Hrs	(5)
Power Consumption	P_L	-	4.16	-	W	(4), $I_L = 6.5\text{ mA}$

Note (1) Lamp current is measured by utilizing a high frequency current meter as shown below:



Note (2) The voltage shown above should be applied to the lamp for more than 1 second after startup. Otherwise the lamp may not be turned on.

Note (3) The lamp frequency may generate interference with horizontal synchronous frequency from the display, and this may cause line flow on the display. In order to avoid interference, the lamp frequency should be detached from the horizontal synchronous frequency and its harmonics as far as possible.

Note (4) $P_L = I_L \times V_L$

Note (5) The lifetime of lamp is defined as the time when it continues to operate under the conditions at $T_a = 25 \pm 2^\circ\text{C}$ and $I_L = 6.5 \text{ mA}_{\text{RMS}}$ until one of the following events occurs:

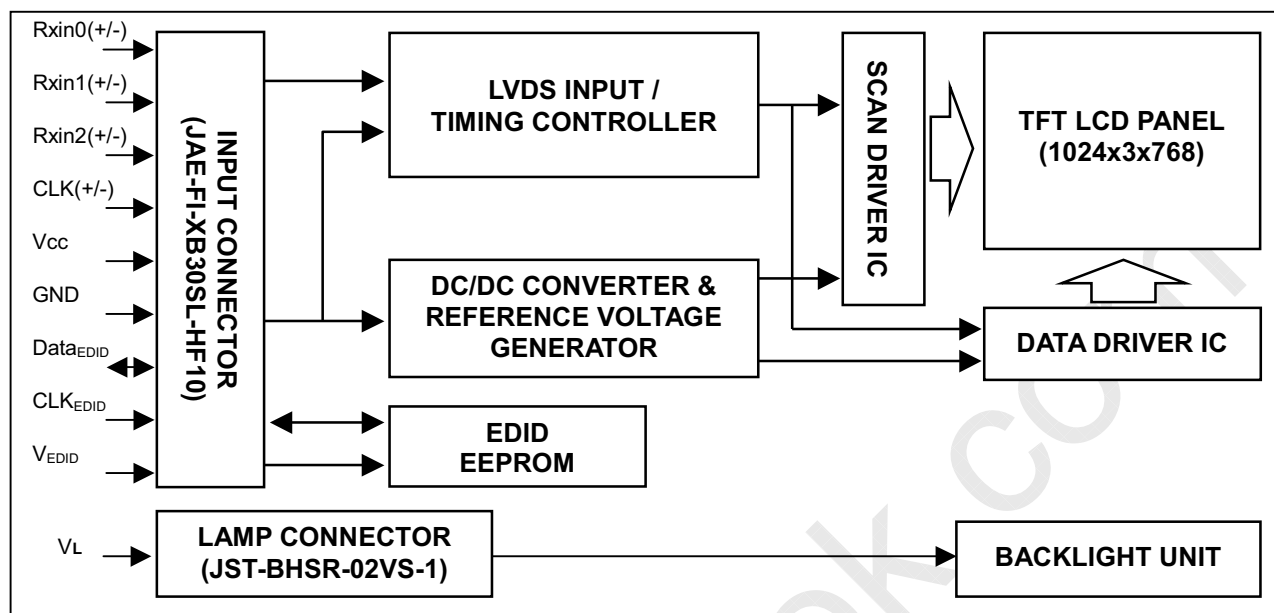
(a) When the brightness becomes $\leq 50\%$ of its original value.

(b) When the effective ignition length becomes $\leq 80\%$ of its original value. (Effective ignition length is defined as an area that the brightness is less than 70% compared to the center point.)

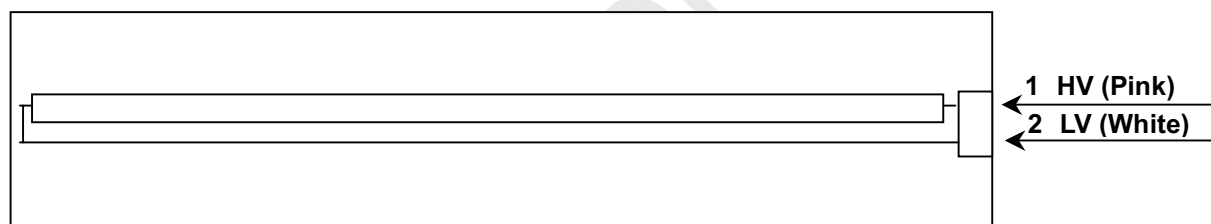
Note (6) The waveform of the voltage output of inverter must be area-symmetric and the design of the inverter must have specifications for the modularized lamp. The performance of the Backlight, such as lifetime or brightness, is greatly influenced by the characteristics of the DC-AC inverter for the lamp. All the parameters of an inverter should be carefully designed to avoid generating too much current leakage from high voltage output of the inverter. When designing or ordering the inverter please make sure that a poor lighting caused by the mismatch of the Backlight and the inverter (miss-lighting, flicker, etc.) never occurs. If the above situation is confirmed, the module should be operated in the same manners when it is installed in your instrument.

4. BLOCK DIAGRAM

4.1 TFT LCD MODULE



4.2 BACKLIGHT UNIT





5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

Pin	Symbol	Description	Polarity	Remark
1	Vss	Ground		-
2	Vcc	Power Supply +3.3 V		-
3	Vcc	Power Supply +3.3 V		-
4	V _{EDID}	DDC +3.3 V		
5	NC	-	-	-
6	CLK _{EDID}	DDC Clock		
7	Data _{EDID}	DDC Data		
8	Rxin0-	LVDS Differential Data Input	Negative	G1~G5,B0,B1
9	Rxin0+	LVDS Differential Data Input	Positive	
10	Vss	Ground		
11	Rxin1-	LVDS Differential Data Input	Negative	B2~B5,Hsync,Vsync,DE
12	Rxin1+	LVDS Differential Data Input	Positive	
13	Vss	Ground		
14	Rxin2-	LVDS Differential Data Input	Negative	B2~B5,Hsync,Vsync,DE
15	Rxin2+	LVDS Differential Data Input	Positive	
16	Vss	Ground		
17	CLK-	LVDS Clock Data Input	Negative	LVDS Level
18	CLK+	LVDS Clock Data Input	Positive	
19	Vss	Ground		
20	NC	-	-	-
21	NC	-	-	-
22	NC	-	-	-
23	NC	-	-	-
24	NC	-	-	-
25	NC	-	-	-
26	NC	-	-	-
27	NC	-	-	-
28	NC	-	-	-
29	NC	-	-	-
30	NC	-	-	-

Note (1) Connector Part No.: JAE-FI-XB30SL-HF10 or equivalent

Note (2) User's connector Part No: JAE-FI-X30C2L or equivalent

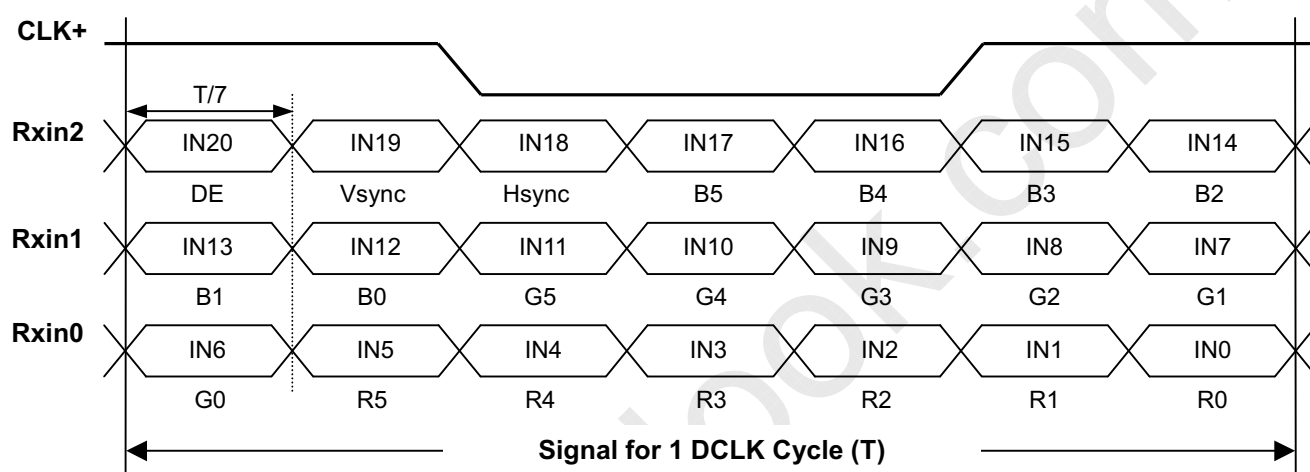
5.2 BACKLIGHT UNIT

Pin	Symbol	Description	Color
1	HV	High Voltage	Pink
2	LV	Ground	White

Note (1) Connector Part No.: JST-BHSR-02VS-1 or equivalent

Note (2) User's connector Part No.: JST-SM02B-BHSS-1-TB or equivalent

5.3 TIMING DIAGRAM OF LVDS INPUT SIGNAL



5.4 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
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	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0	
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
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	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0	0
Blue(63)	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	

Note (1) 0: Low Level Voltage, 1: High Level Voltage

5.5 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the VESA Plug & Display and FPD1 standards.

Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
0	0	Header	TBD	TBD
1	1	Header	TBD	TBD
2	2	Header	TBD	TBD
3	3	Header	TBD	TBD
4	4	Header	TBD	TBD
5	5	Header	TBD	TBD
6	6	Header	TBD	TBD
7	7	Header	TBD	TBD
8	8	EISA ID manufacturer name ("TBD")	TBD	TBD
9	9	EISA ID manufacturer name (Compressed ASCII)	TBD	TBD
10	0A	ID product code (N141X7 = " TBD")	TBD	TBD
11	0B	ID product code (hex LSB first)	TBD	TBD
12	0C	ID S/N (fixed "0")	TBD	TBD
13	0D	ID S/N (fixed "0")	TBD	TBD
14	0E	ID S/N (fixed "0")	TBD	TBD
15	0F	ID S/N (fixed "0")	TBD	TBD
16	10	Week of manufacture (fixed "TBD")	TBD	TBD
17	11	Year of manufacture (fixed "TBD")	TBD	TBD
18	12	EDID structure version # ("1")	TBD	TBD
19	13	EDID revision # ("3")	TBD	TBD
20	14	Video I/P definition ("digital")	TBD	TBD
21	15	Max H image size ("28 cm")	TBD	TBD
22	16	Max V image size ("21 cm")	TBD	TBD
23	17	Display Gamma (Gamma = " 2.2")	TBD	TBD
24	18	Feature support ("RGB, preferred timing")	TBD	TBD
25	19	Red/Green (Rx1, Rx0, Ry1, Ry0, Gx1, Gx0, Gy1, Gy0)	TBD	TBD
26	1A	Blue/White (Bx1, Bx0, By1, By0, Wx1, Wx0, Wy1, Wy0)	TBD	TBD
27	1B	Red-x (Rx = "TBD")	TBD	TBD
28	1C	Red-y (Ry = "TBD")	TBD	TBD
29	1D	Green-x (Gx = " TBD")	TBD	TBD
30	1E	Green-y (Gy = " TBD")	TBD	TBD
31	1F	Blue-x (Bx = " TBD")	TBD	TBD
32	20	Blue-y (By = " TBD")	TBD	TBD
33	21	White-x (Wx = " TBD")	TBD	TBD
34	22	White-y (Wy = " TBD")	TBD	TBD
35	23	Established timings 1	TBD	TBD
36	24	Established timings 2 (1024x768@60Hz)	TBD	TBD
37	25	Manufacturer' s reserved timings	TBD	TBD
38	26	Standard timing ID # 1	TBD	TBD
39	27	Standard timing ID # 1	TBD	TBD
40	28	Standard timing ID # 2	TBD	TBD
41	29	Standard timing ID # 2	TBD	TBD



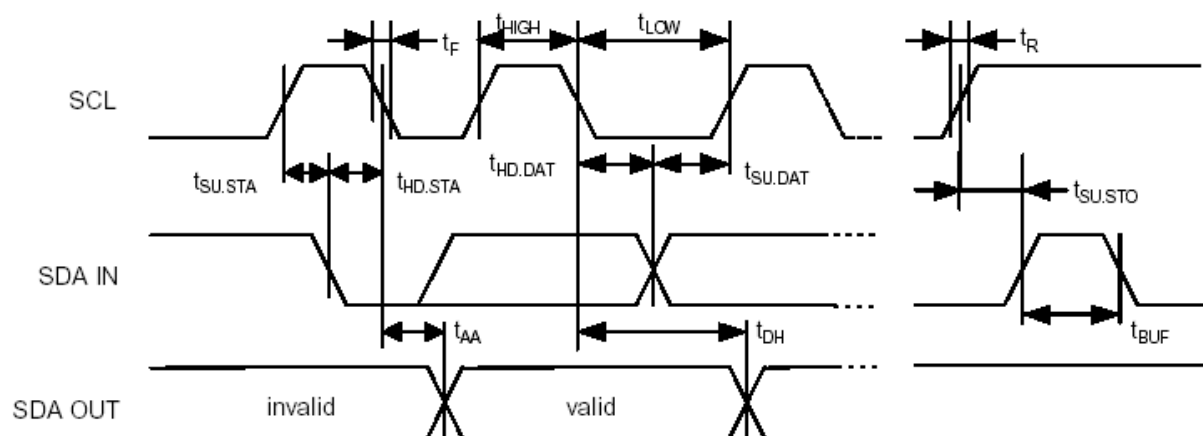
Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
42	2A	Standard timing ID # 3	TBD	TBD
43	2B	Standard timing ID # 3	TBD	TBD
44	2C	Standard timing ID # 4	TBD	TBD
45	2D	Standard timing ID # 4	TBD	TBD
46	2E	Standard timing ID # 5	TBD	TBD
47	2F	Standard timing ID # 5	TBD	TBD
48	30	Standard timing ID # 6	TBD	TBD
49	31	Standard timing ID # 6	TBD	TBD
50	32	Standard timing ID # 7	TBD	TBD
51	33	Standard timing ID # 7	TBD	TBD
52	34	Standard timing ID # 8	TBD	TBD
53	35	Standard timing ID # 8	TBD	TBD
54	36	Detailed timing description # 1 Pixel clock ("65 MHz")	TBD	TBD
55	37	# 1 Pixel clock (hex LSB first)	TBD	TBD
56	38	# 1 H active ("1024")	TBD	TBD
57	39	# 1 H blank ("320")	TBD	TBD
58	3A	# 1 H active: H blank ("1024 : 320")	TBD	TBD
59	3B	# 1 V active (" 768")	TBD	TBD
60	3C	# 1 V blank (" 38")	TBD	TBD
61	3D	# 1 V active: V blank (" 768 : 38")	TBD	TBD
62	3E	# 1 H sync offset (" 24")	TBD	TBD
63	3F	# 1 H sync pulse width (" 136")	TBD	TBD
64	40	# 1 V sync offset: V sync pulse width (" 3 : 6")	TBD	TBD
65	41	# 1 H sync offset: H sync pulse width : V sync offset : V sync width (" 24 : 136 : 3 : 6")	TBD	TBD
66	42	# 1 H image size (" 285 mm")	TBD	TBD
67	43	# 1 V image size (" 214 mm")	TBD	TBD
68	44	# 1 H image size: V image size (" 285 : 214")	TBD	TBD
69	45	# 1 H boarder (" 0")	TBD	TBD
70	46	# 1 V boarder (" 0")	TBD	TBD
71	47	# 1 Flags (" Non-Interlace, Non-Stereo, Digital Separate")	TBD	TBD
72	48	Detailed timing description # 2	TBD	TBD
73	49	# 2 Flag	TBD	TBD
74	4A	# 2 Reserved	TBD	TBD
75	4B	# 2 FE (hex) defines ASCII string (Model Name "N141X7" , ASCII)	TBD	TBD
76	4C	# 2 Flag	TBD	TBD
77	4D	# 2 1st character of string ("N")	TBD	TBD
78	4E	# 2 2nd character of string ("1")	TBD	TBD
79	4F	# 2 3rd character of string ("4")	TBD	TBD
80	50	# 2 4th character of string ("1")	TBD	TBD
81	51	# 2 5th character of string ("X")	TBD	TBD
82	52	# 2 6th character of string ("7")	TBD	TBD
83	53	# 2 New line character # 2 indicates end of ASCII string	TBD	TBD
84	54	# 2 Padding with "Blank" character	TBD	TBD
85	55	# 2 Padding with "Blank" character	TBD	TBD
86	56	# 2 Padding with "Blank" character	TBD	TBD

Byte # (decimal)	Byte # (hex)	Field Name and Comments	Value (hex)	Value (binary)
87	57	# 2 Padding with "Blank" character	TBD	TBD
88	58	# 2 Padding with "Blank" character	TBD	TBD
89	59	# 2 Padding with "Blank" character	TBD	TBD
90	5A	Detailed timing description # 3	TBD	TBD
91	5B	# 3 Flag	TBD	TBD
92	5C	# 3 Reserved	TBD	TBD
93	5D	# 3 FE (hex) defines ASCII string (Model Name "N141X7" , ASCII)	TBD	TBD
94	5E	# 3 Flag	TBD	TBD
95	5F	# 3 1st character of string ("N")	TBD	TBD
96	60	# 3 2nd character of string ("1")	TBD	TBD
97	61	# 3 3rd character of string ("4")	TBD	TBD
98	62	# 3 4th character of string ("1")	TBD	TBD
99	63	# 3 5th character of string ("X")	TBD	TBD
100	64	# 3 6th character of string ("7")	TBD	TBD
101	65	# 3 New line character # 3 indicates end of ASCII string	TBD	TBD
102	66	# 3 Padding with "Blank" character	TBD	TBD
103	67	# 3 Padding with "Blank" character	TBD	TBD
104	68	# 3 Padding with "Blank" character	TBD	TBD
105	69	# 3 Padding with "Blank" character	TBD	TBD
106	6A	# 3 Padding with "Blank" character	TBD	TBD
107	6B	# 3 Padding with "Blank" character	TBD	TBD
108	6C	Detailed timing description # 4	TBD	TBD
109	6D	# 4 Flag	TBD	TBD
110	6E	# 4 Reserved	TBD	TBD
111	6F	# 4 FC (hex) defines Monitor name ("Color LCD" , ASCII)	TBD	TBD
112	70	# 4 Flag	TBD	TBD
113	71	# 4 1st character of name ("C")	TBD	TBD
114	72	# 4 2nd character of name ("o")	TBD	TBD
115	73	# 4 3rd character of name ("l")	TBD	TBD
116	74	# 4 4th character of name ("o")	TBD	TBD
117	75	# 4 5th character of name ("r")	TBD	TBD
118	76	# 4 6th character of name (<space>)	TBD	TBD
119	77	# 4 7th character of name ("L")	TBD	TBD
120	78	# 4 8th character of name ("C")	TBD	TBD
121	79	# 4 9th character of name ("D")	TBD	TBD
122	7A	# 4 New line character # 4 indicates end of Monitor name	TBD	TBD
123	7B	# 4 Padding with "Blank" character	TBD	TBD
124	7C	# 4 Padding with "Blank" character	TBD	TBD
125	7D	# 4 Padding with "Blank" character	TBD	TBD
126	7E	Extension flag	TBD	TBD
127	7F	Checksum	TBD	TBD

5.6 EDID SIGNAL SPECIFICATION

(1) EDID Power

Parameter	Symbol	Conditions	Min.	Typ.	Max.	Unit
Power supply voltage	Vcc	Read Operation	2.2	—	5.5	V



(2) DC characteristics

		Symbol	Min.	Max.	Unit	Index
SCL, SDA terminal input voltage	High Voltage	VIH	0.7×Vcc	—	V	
	Low Voltage	VIL	—	0.3×Vcc	V	
Hysteresis Voltage		VHYS	0.05 VCC	—	V	
Output Voltage		VOL1 VOL2	—	0.4 0.6	V	IOL=3mA, CC=2.5V IOL=6mA, CC=2.5V
Input Leak current (Vin =0.1V~VCC)		ILI	-10 -10	10 50	uA	WP=VSS WP=VCC
Output Leak current		ILO	-10	10	uA	Vout =0.1V~VCC, WP=VSS
Terminal capacity(Input, Output)		Cin, Cout	—	10	pF	VCC=5.0V Ta=25°C, Fclk=1.0MHz
Operating current		ICC Write ICC Read	—	3 1	mA	VCC=5.5V, SCL=400KHz
Stillness current (SDA=SCL=VCC) (WP=VSS,A0,A1,A2=VSS)		ICCS	—	30 100	uA	VCC=3.0V VCC=5.5V



(3) AC characteristics (VCC=2.5~5.5V standard operation mode)

Item	Symbol	VCC=2.5V-5.5V (Standard operation mode)		VCC=4.5V-5.5V (High-speed operation mode)		Unit Index	
		Min.	Max.	Min.	Max.		
Clock frequency	Fclk	—	100	—	400	KHz	
Clock High Time	THIGH	4000	—	900	—	ns	
Clock Low Time	TLOW	4700	—	1300	—	ns	
SDA, SCL falling time	TR	—	1000	—	300	ns	
SDA, SCL rising time	TF	—	300	—	300	ns	
START hold time	THD: STA	4000	—	600	—	ns	
START setup time	TSU: STA	4700	—	600	—	ns	
Data input hold time	THD: Data	0	—	0	—	ns	
Data input setup time	TSU: Data	250	—	100	—	ns	
STOP setup time	TSU: STO	4700	—	600	—	ns	
Output decision time from a clock	TAA	—	3500	100	900	ns	
Bus free time	TBUF	4700	—	1300	—	ns	
Rising time of Min VIH, VIL	TOF	—	250	20	250	ns	CB ≤ 100pF
Spike oppression	TSP	—	50	—	50	ns	
A write-in cycle time	TWR	—	10	—	10	ms	Byte and page mode
The number of times of data rewriting	—	1M	—	1M	—	cycles	VCC=5.0V Ta=25°C,

6. INTERFACE TIMING

6.1 INPUT SIGNAL TIMING SPECIFICATIONS

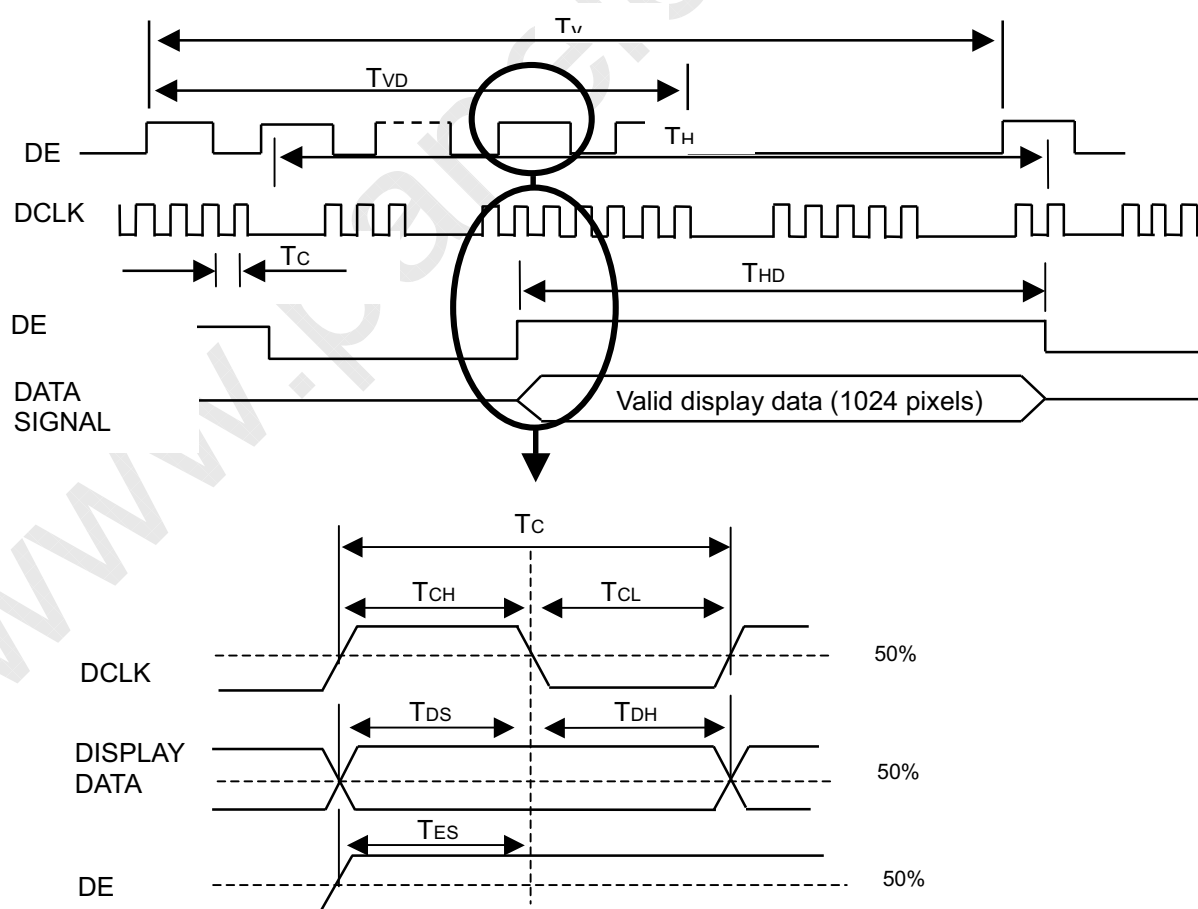
The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
Clock	Frequency	1/Tc	40	65	80	MHz	-
	High Time	T _{CH}	13	-	-	nsec	-
	Low Time	T _{CL}	13	-	-	nsec	-
Data	Setup Time	T _{DS}	4	-	-	nsec	-
	Hold Time	T _{DH}	4	-	-	nsec	-
Vsync Frequency	Frequency	Vsync	-	60	-	Hz	-
Hsync Frequency	Frequency	Hsync	-	48	-	KHz	-
Data Enable	Pulse width	T _{DEP}	100	-	-	clocks	(1)
Data Enable	Setup Time	T _{ES}	3.5	4.0	-	nsec	(1)
Frame Frequency	Cycle	T _V	770	806	1000	lines	-
Vertical Active Display Term	Display Period	T _{VD}	-	768	-	lines	-
One Line Scanning Time	Cycle	T _H	1180	1344	2000	clocks	(2)
Horizontal Active Display Term	Display Period	T _{HD}	-	1024	-	clocks	-

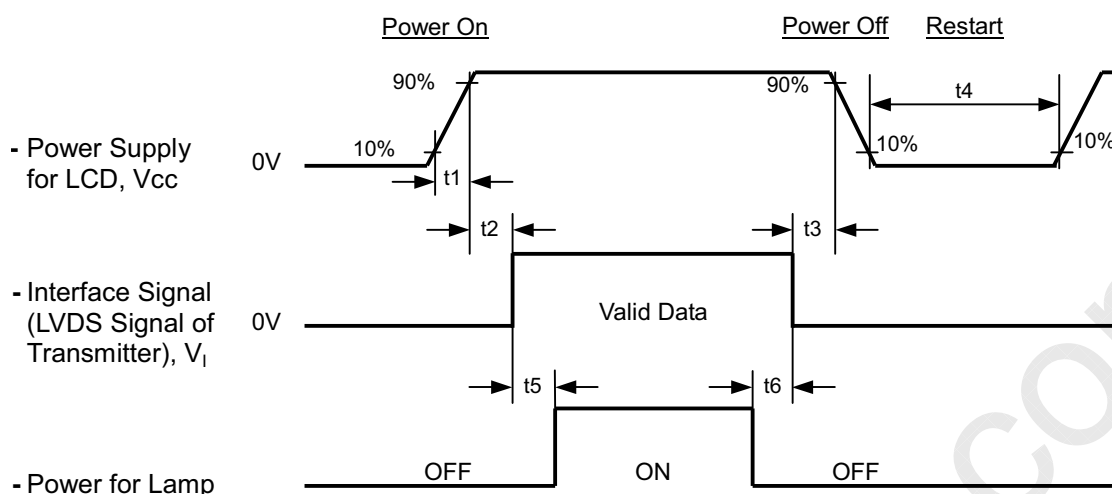
Note (1) Because this module is operated by DE only mode, Hsync and Vsync input signals should be set to low logic level or ground. Otherwise, this module would operate abnormally.

Note (2) The duration of DE signal must be longer than 1 clock period at every horizontal sync. period.

INPUT SIGNAL TIMING DIAGRAM



6.2 POWER ON/OFF SEQUENCE



Timing Specifications:

$$0 < t_1 \leq 15 \text{ msec}$$

$$0 < t_2 \leq 45 \text{ msec}$$

$$0 < t_3 \leq 45 \text{ msec}$$

$$t_4 \geq 400 \text{ msec}$$

$$t_5 \geq 200 \text{ msec}$$

$$t_6 \geq 200 \text{ msec}$$

Note (1) Please avoid floating state of interface signal at invalid period.

Note (2) When the interface signal is invalid, be sure to pull down the power supply of LCD V_{cc} to 0 V.

Note (3) The Backlight inverter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.



7. OPTICAL CHARACTERISTICS

7.1 TEST CONDITIONS

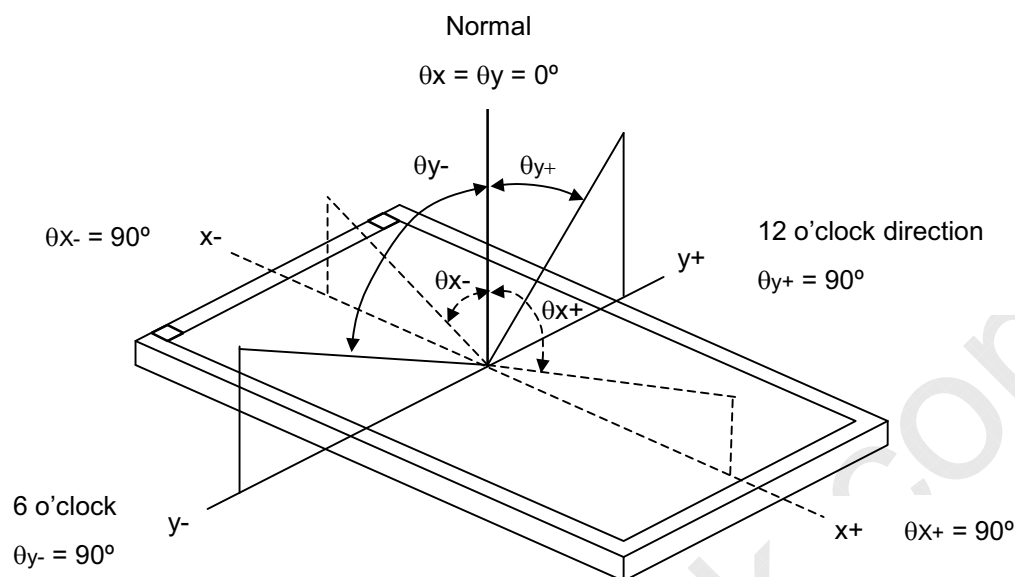
Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	°C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V _{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
Inverter Current	I _L	6.5	mA
Inverter Driving Frequency	F _L	55	KHz
Inverter	Sumida-H05-4783B		

The measurement methods of optical characteristics are shown in Section 7.2. The following items should be measured under the test conditions described in Section 7.1 and stable environment shown in Note (6).

7.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Contrast Ratio		CR	$\theta_x=0^\circ, \theta_Y=0^\circ$ Viewing Normal Angle	(150)	(200)	-	-	(2), (6)
Response Time		T _R		-	15	30	ms	(3)
		T _F		-	35	50	ms	
Average Luminance of White		L _{AVE}		(140)	(170)	-	cd/m ²	(4), (6)
White Variation		δW		-	-	(1.4)	-	(6), (7)
Cross Talk		CT		-	-	(4.0)	%	(5), (6)
Color Chromaticity	Red	R _x		(0.537)	(0.577)	(0.617)	-	(1), (6)
		R _y		(0.308)	(0.338)	(0.368)	-	
	Green	G _x		(0.280)	(0.310)	(0.340)	-	
		G _y		(0.524)	(0.554)	(0.584)	-	
	Blue	B _x		(0.128)	(0.158)	(0.188)	-	
		B _y		(0.084)	(0.124)	(0.164)	-	
	White	W _x		(0.283)	0.313	(0.343)	-	
		W _y		(0.299)	0.329	(0.359)	-	
Color Gamut		C.G%			45	-	%	(8)
Viewing Angle	Horizontal	θ _{x+}	CR≥10	40	45	-	Deg.	(1), (6)
		θ _{x-}		40	45	-		
	Vertical	θ _{y+}		10	15	-		
		θ _{y-}		30	35	-		

Note (1) Definition of Viewing Angle (θ_x , θ_y):



Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

$$\text{Contrast Ratio (CR)} = L_{63} / L_0$$

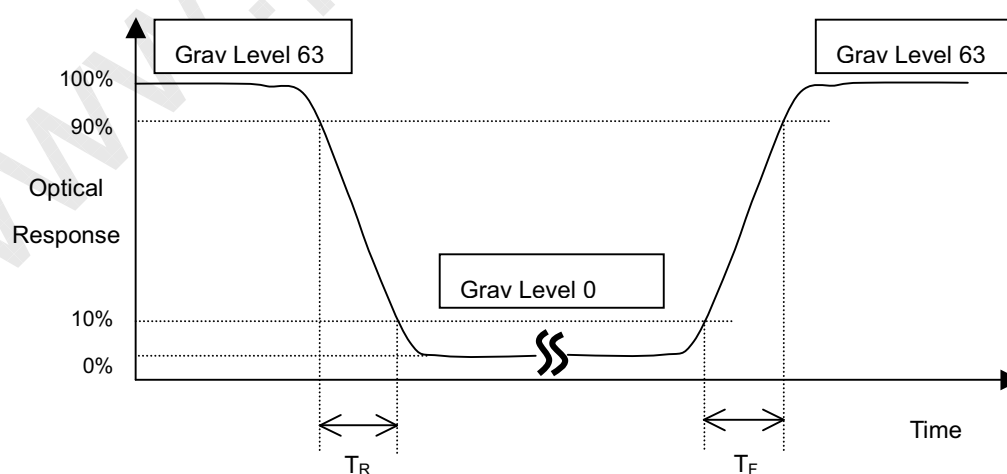
L63: Luminance of gray level 63

L 0: Luminance of gray level 0

$$\text{CR} = \text{CR} (5)$$

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (7).

Note (3) Definition of Response Time (T_R , T_F):



Note (4) Definition of Average Luminance of White (L_{AVE}):

Measure the luminance of gray level 63 at 5 points

$$L_{AVE} = [L(1) + L(2) + L(3) + L(4) + L(5)] / 5$$

$L(x)$ is corresponding to the luminance of the point X at Figure in Note (7).

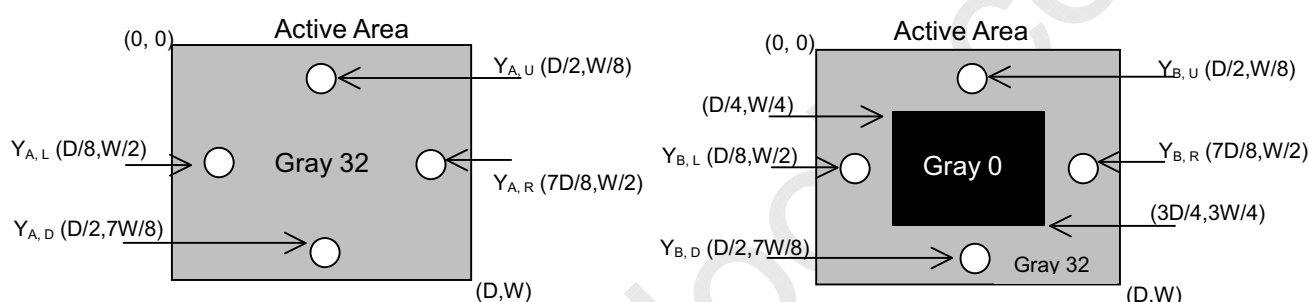
Note (5) Definition of Cross Talk (CT):

$$CT = |Y_B - Y_A| / Y_A \times 100 (\%)$$

Where:

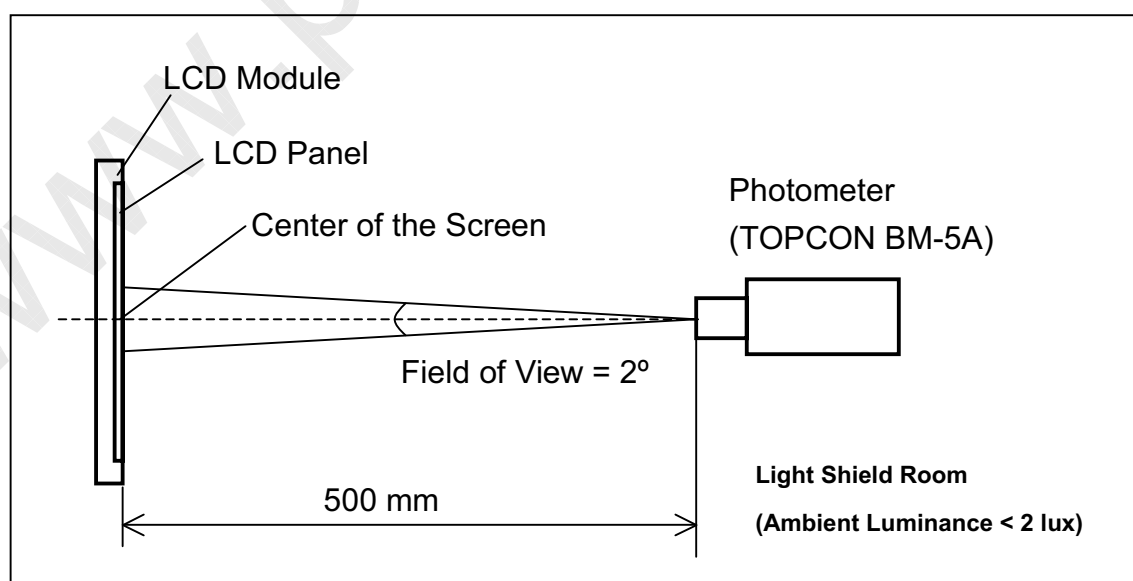
Y_A = Luminance of measured location without gray level 0 pattern (cd/m^2)

Y_B = Luminance of measured location with gray level 0 pattern (cd/m^2)



Note (6) Measurement Setup:

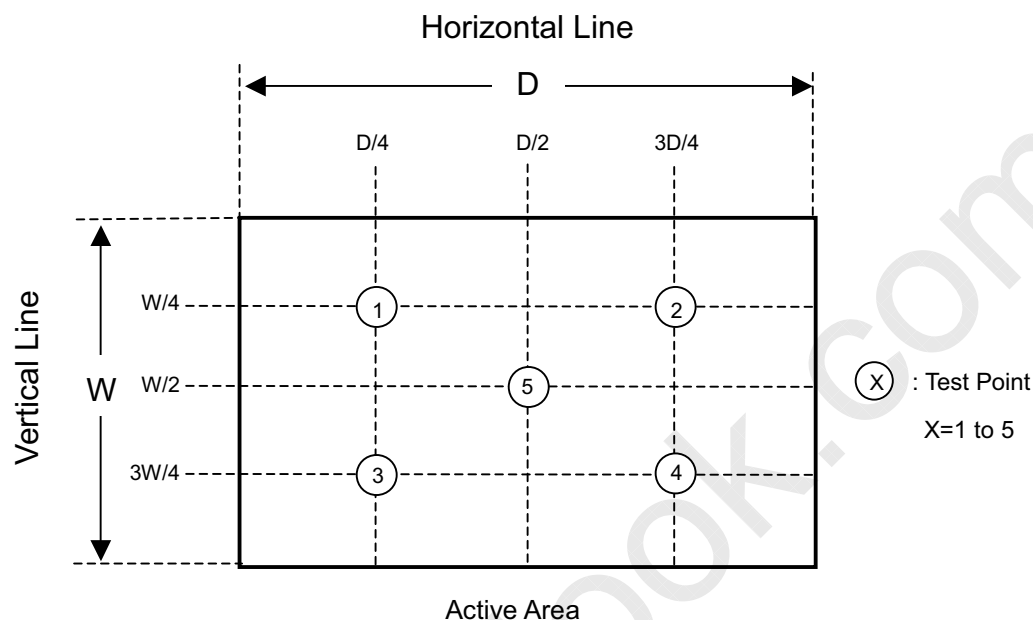
The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.



Note (7) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

$$\delta W = \text{Maximum } [L(1), L(2), L(3), L(4), L(5)] / \text{Minimum } [L(1), L(2), L(3), L(4), L(5)]$$



Note (8) Definition of color gamut (C.G%):

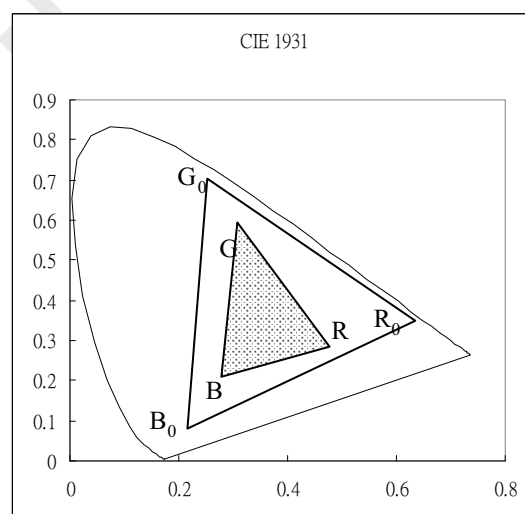
$$C.G\% = \Delta R G B / \Delta R_0 G_0 B_0, *100\%$$

R_0, G_0, B_0 : color coordinates of red, green, and blue defined by NTSC, respectively.

R, G, B : color coordinates of module on 63 gray levels of red, green, and blue, respectively.

$\Delta R_0 G_0 B_0$: area of triangle defined by R_0, G_0, B_0

$\Delta R G B$: area of triangle defined by R, G, B



8. PRECAUTIONS

8.1 HANDLING PRECAUTIONS

- (1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.
- (2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.
- (3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.
- (4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.
- (5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.
- (6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.
- (7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.
- (8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.
- (9) Do not disassemble the module.
- (10) Do not pull or fold the lamp wire.
- (11) Pins of I/F connector should not be touched directly with bare hands.

8.2 STORAGE PRECAUTIONS

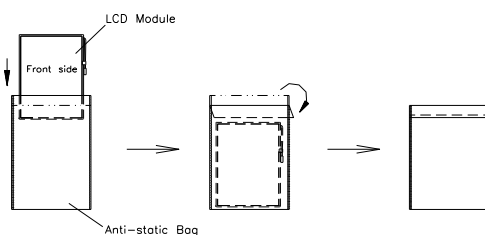
- (1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.
- (2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.
- (3) It may reduce the display quality if the ambient temperature is lower than 10 °C. For example, the response time will become slowly, and the starting voltage of lamp will be higher than the room temperature.

8.3 OPERATION PRECAUTIONS

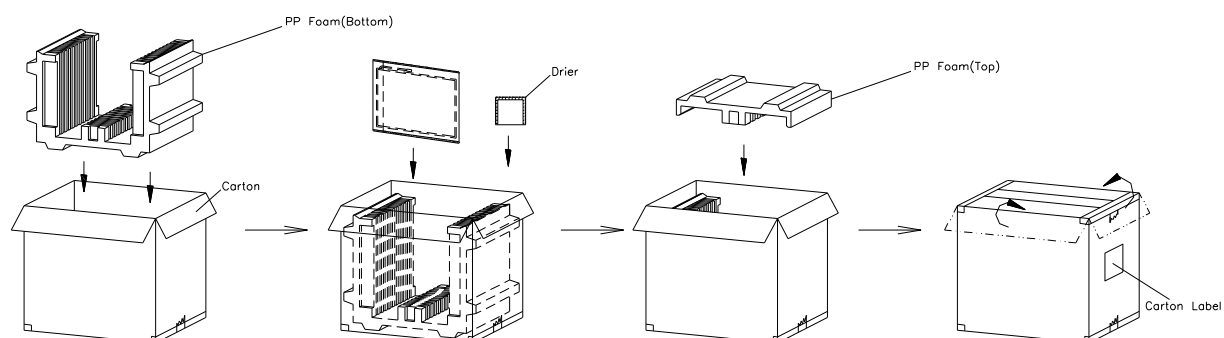
- (1) Do not pull the I/F connector in or out while the module is operating.
- (2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.
- (3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with inverter. Do not disassemble the module or insert anything into the Backlight unit.

9. PACKING

9.1 CARTON

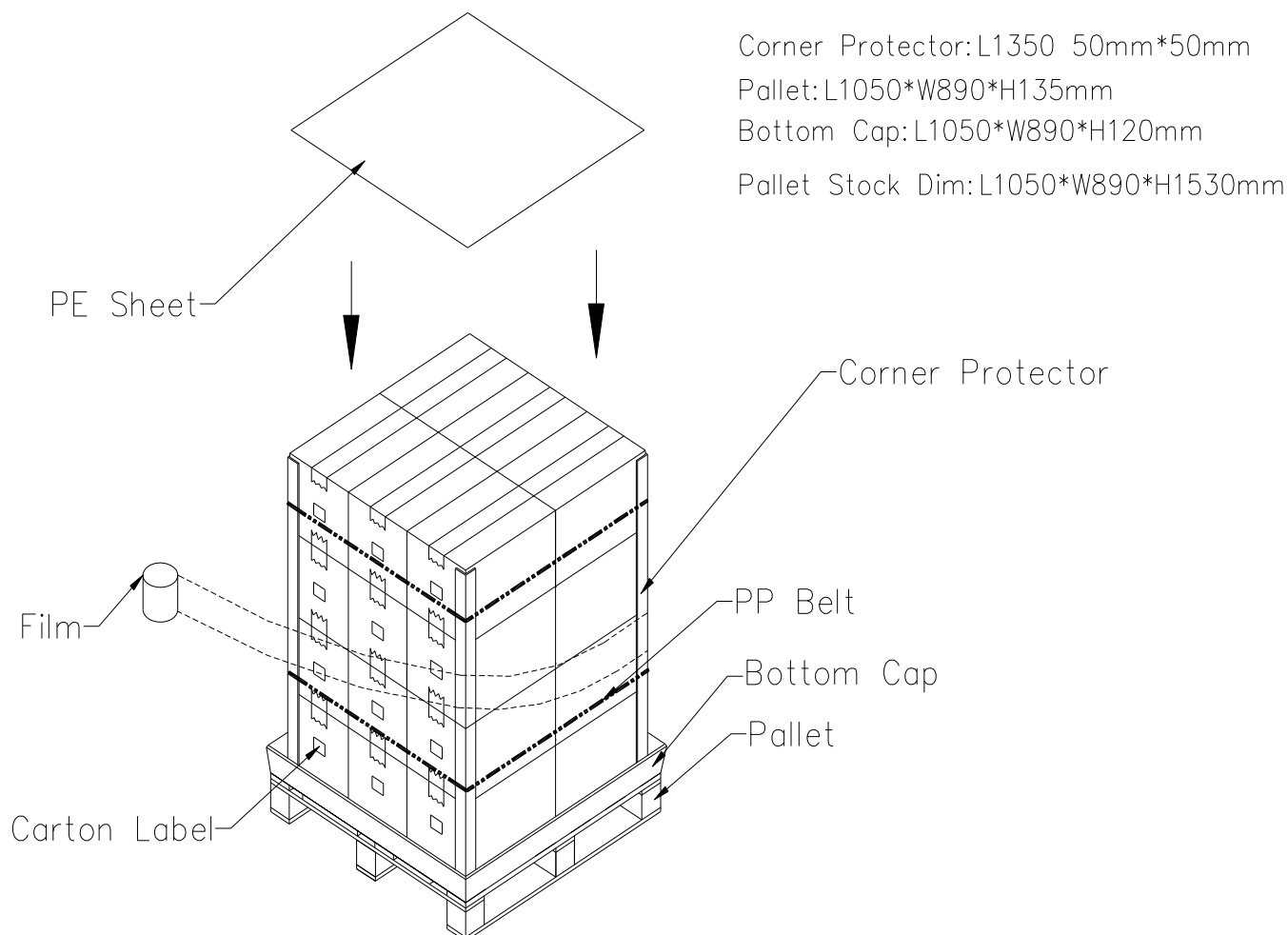


Box dimensions: 422(L)x337(W)x345(H)mm
 Weight: Approx. 7.0Kg(10modules per 1 box)





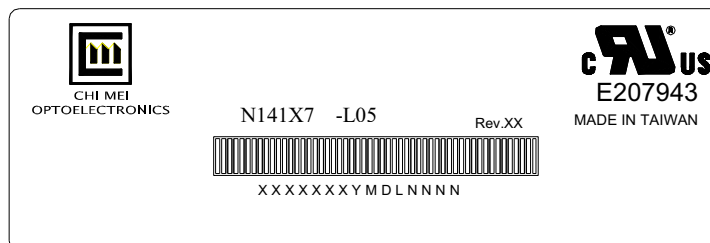
9.2 PALLET



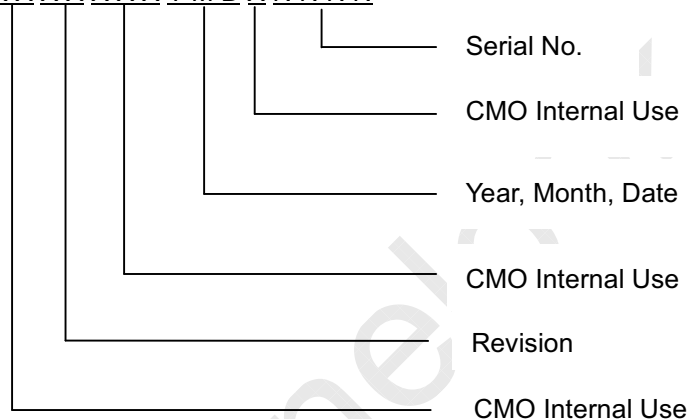
10. DEFINITION OF LABELS

10.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.



- (a) Model Name: N141X7 - L05
 (b) Revision: Rev. XX, for example: C1, C2 ...etc.
 (c) Serial ID: XXXXXX Y MD XXXX



Serial ID includes the information as below:

- (a) Manufactured Date: Year: 1~9, for 2001~2009
 Month: 1~9, A~C, for Jan. ~ Dec.
 Day: 1~9, A~Y, for 1st to 31st, exclude I, O and U
 (b) Revision Code: cover all the change
 (c) Serial No.: Manufacturing sequence of product



Issued Date: Dec. 04, 2002

Model No.: N141X7 -L05

Preliminary

10.2 CARTON LABEL

The image shows a template for a carton label. At the top left is the CHI MEI OPTOELECTRONICS logo. Below it, the text "CHI MEI OPTOELECTRONICS" is printed. The label contains four lines of text, each followed by a horizontal line for input: "PO.NO.", "Part ID.", "Model Name", and "Carton ID.". To the right of the "Carton ID." line, the word "Quantities" is printed. The background of the label has a faint, large "CMO" watermark.

